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Agricultural Memorandum No. 283

Weather and the Soft Resin Content of Hops

Details of the quality of hops grown at Bodiam are available from 1921 to date. Examination of the percentage of soft resins suggest that there was an appreciable rise in quality from 1921 to 1939, a drop during the war years and a rise thereafter.

This improvement could be due to better husbandry or to changes in variety, and since 1948 amounts to an average of 0.13 percentage content per year.

The start and duration of hop-picking are known, but it is not certain whether the quoted resin percentages form a fair sample, or whether the quality changes from early picking to late picking (although this is considered unlikely).

Previous work on international trials had suggested that there was a critical temperature between 16° and 17°C during the maturing stages for best alpha-acid contents. This is equivalent to 60.8° - 62.6°F . The Bodiam results suggest an optimum at about 61.5°F .

It also appeared likely that there was an optimum potential transpiration level during August at 3.50 inches. More or less sunshine during this month seemed to depress the quality.

Appendix I shows the result of the first attempt at analysis using July 1st to the start of picking as the critical temperature period and the month of August for critical sunshine.

No influence of rainfall or soil moisture deficit could be identified.

Appendix II examines the effect of low or high temperatures considered separately which does not greatly alter the efficiency of the estimates.

Appendix III examines the deviation from optimum temperatures over 10 day (decad) periods.

Two major difficulties impede closer examination, the lack of knowledge of the date of "flowering" to determine the possible start of the critical period, and absence of knowledge of any disease effects on quality.

The main conclusion of this analysis is the confirmation of the probable existence of an optimum temperature regime.

Any comments or criticism on this paper should be sent to the author.

Appendix I

Using the following parameters

A = deviation of August Potential Transpiration from an optimum of 3.50 in.

B = deviation of mean air temperature between July 1 and start of hop-picking from an optimum of 61.5°F.

n = number of years after 1948.

and the formula $8.80 - 1.2A - 0.45B + 0.13 n$

<u>Year</u>	<u>Percentage</u> <u>Soft resins</u>	<u>A</u>	<u>B</u>	<u>n</u>	<u>Estimate</u>	<u>Error</u>
1948	7.1	0.60	1.6	0	7.4	+ 0.3
1949	7.9	0.20	1.7	1	7.9	0.0
1950	9.2	0.10	0.5	2	8.7	- 0.5
1951	8.5	0.35	0.9	3	8.4	- 0.1
1952	8.1	0.20	1.1	4	8.6	+ 0.5
1953	9.5	0.30	0.2	5	9.0	- 0.5
1954	8.0	0.40	2.4	6	8.0	0
1955	8.9	0.05	1.7	7	8.9	0
1956	8.8	0.25	2.0	8	8.6	- 0.2
1957	8.8	0.25	1.3	9	9.1	+ 0.3
1958	9.0	0.80	0.8	10	8.8	- 0.2
1959	8.6	0.20	2.1	11	9.0	+ 0.4
1960	9.0	0.30	1.7	12	9.2	+ 0.2
1961	9.7	0.30	0.2	13	10.0	+ 0.3
1962	10.0	0.05	2.3	14	9.5	- 0.5
1963	9.5	0.50	1.9	15	9.3	- 0.2
1964	10.4	0.15	0.2	16	10.6	+ 0.2

Mean error = 0.26

Root Mean square 0.31

Appendix II

Using the following parameters

A = deviation of August Potential Transpiration from an optimum of 3.50 in.

C = deficiency of mean air temperature between July 1 and start of hop-picking below optimum of 61.5°F

D = excess of mean air temperature between July 1 and start of hop-picking above optimum of 61.5°F

n = number of years after 1948.

and the formula

$$8.95 - 1.6A - 0.4C - 0.6D + 0.13n$$

<u>Year</u>	<u>Percentage Soft resin</u>	<u>A</u>	<u>C</u>	<u>D</u>	<u>n</u>	<u>Estimate</u>	<u>Error</u>
1948	7.1	0.60	1.6	0	0	7.3	+ 0.2
1949	7.9	0.20	0	1.7	0	7.7	- 0.2
1950	9.2	0.10	0	0.5	2	8.7	- 0.5
1951	8.5	0.35	0.9	0	3	8.4	- 0.1
1952	8.1	0.20	0	1.1	4	8.5	+ 0.4
1953	9.5	0.30	0.2	0	5	9.0	- 0.5
1954	8.0	0.40	2.4	0	6	8.1	+ 0.1
1955	8.9	0.05	0	1.7	7	8.8	- 0.1
1956	8.8	0.25	2.0	0	8	8.8	0.0
1957	8.8	0.25	0	1.3	9	8.9	+ 0.1
1958	9.0	0.80	0.8	0	10	8.7	- 0.3
1959	8.6	0.20	0	2.1	11	8.8	+ 0.2
1960	9.0	0.30	1.7	0	12	9.3	+ 0.3
1961	9.7	0.30	0.2	0	13	10.1	+ 0.4
1962	10.0	0.05	2.3	0	14	9.8	- 0.2
1963	9.5	0.50	1.9	0	15	9.3	- 0.2
1964	10.4	0.15	0	0.2	16	10.7	+ 0.3

Mean error = 0.24

Root mean square 0.28

Appendix III

Using the following parameters

A = deviation of August Potential Transpiration from an optimum of 3.50 in.

E = cumulative deviation over decades between July 1 and start of hop-picking
weighted 6 : 4 for deficiency and excess.

n = number of years after 1948

and the formula $9.12 - 1.1A - 0.43E + 0.13n$

<u>Year</u>	<u>Percentage</u> <u>Soft resin</u>	<u>A</u>	<u>E</u>	<u>n</u>	<u>Estimate</u>	<u>Error</u>
1948	7.1	0.60	4.0	0	6.7	- 0.4
1949	7.9	0.20	2.9	1	7.8	- 0.1
1950	9.2	0.10	1.0	2	8.8	- 0.4
1951	8.5	0.35	1.5	3	8.5	0.0
1952	8.1	0.20	1.8	4	8.6	+ 0.5
1953	9.5	0.30	1.0	5	9.0	- 0.5
1954	8.0	0.40	2.3	6	8.5	+ 0.5
1955	8.9	0.05	3.4	7	8.5	- 0.4
1956	8.8	0.25	2.2	8	8.9	+ 0.1
1957	8.8	0.25	2.9	9	8.8	0
1958	9.0	0.80	1.3	10	9.0	0
1959	8.6	0.20	2.9	11	9.1	+ 0.5
1960	9.0	0.30	1.7	12	9.6	+ 0.6
1961	9.7	0.30	1.4	13	9.8	+ 0.1
1962	10.0	0.05	2.3	14	9.9	- 0.1
1963	9.5	0.50	2.9	15	9.3	- 0.2
1964	10.4	0.15	1.7	16	10.3	- 0.1

Mean Error = 0.26

Root mean square 0.34